Understanding the Probability of a Disability Resulting from Work-Related Injuries

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15. SUBJECT TERMS
work-related injury; disability; lost productivity; work absence; return to work; Federal Employeesâ Compensation Act; FECA; loss of earnings

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Keywords: work-related injury; disability; lost productivity; work absence; return to work; Federal Employees' Compensation Act; FECA; loss of earnings

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I. Introduction

Approximately 3.8 million American workers sustained a work-related injury in 2013, with about 30 percent missing work as a result.[1,2] These injured workers might face reduced job opportunities[3] and their employers might face payments for medical treatments and lost wages.[4] Most of these costs are incurred by disabilities among a small proportion of injured workers. For example, workers' compensation programs paid approximately $61.9 billion in medical and wage replacement benefits in 2010, with 25 percent of the injuries accounting for 94 percent of the costs.[5] Similarly, 11 percent of injuries reported under the Federal Employees' Compensation Act (FECA) involved a disability and incurred an average of nearly $20,000 in wage replacement and medical benefits in the first year—much greater than the $3,000 average across all reported injuries (authors' calculations). Here are below, we refer to injuries, which are sudden events, and illnesses, which develop over time, collectively as injuries when the distinction is not relevant.

The high cost of disabilities from work-related injuries has motivated important research questions: which types of workers are at greatest risk of injury, and which injuries are most likely to result in a disability? Policymakers and program heads could use the answers to these questions to better target resources and improve safety nets for injured workers most at risk of diminished earnings and to help employers plan for replacement workers. Unfortunately, many of the existing studies on such probabilities and on risk factors—individual, workplace, and other characteristics associated with a greater likelihood of disability—suffer from the use of less than adequate data.[6]

This study uses a previously untapped data source—administrative data on workplace injuries reported under FECA—to better understand factors associated with the probability that a workplace injury results in a disability (disability probability). Both FECA and supplemental data from FedScope enable us to assess how the probability an employee will incur a work-related injury (incidence rate) might influence the interpretation of the disability probability, how inaccuracies—which vary by worker group defined by demographics or injury type—arise in the disability probability when omitting key risk factors from analysis, and how the relationship between the disability probability and risk factors varies across worker groups.

II. Framework

Understanding the factors associated with incurring a disability from a work-related injury requires understanding two events: incurring an injury and that injury causing a disability. The injury incidence rate may vary with worker demographics and employment characteristics:

(1) $\Pr(I_i) = f(\mathbf{X}_{1i}, \mathbf{X}_{2i})$,

where $\Pr(I_i)$ is the probability that worker *i* sustains a work-related injury in a given time period. Past research has confirmed relationships between injury incidence rates and measures of demographics ($\mathbf{X}_1$), such as age, gender, and race/ethnicity,[7,8,9] and employment characteristics ($\mathbf{X}_2$), including occupation, industry, union representation, hours worked, tenure,[10,11,12,13] environmental conditions, policies and programs, and organization and co-worker support.[14]

The disability probability among injured workers may vary with many of the same characteristics, as well as the type and severity of the injury ($\mathbf{X}_3$) and the receipt of injury-appropriate services, including medical services or workplace accommodations ($\mathbf{X}_4$):

(2) $\Pr(D_i | I) = g(\mathbf{X}_{1i}, \mathbf{X}_{2i}, \mathbf{X}_{3i}, \mathbf{X}_{4i})$.

where $\Pr(D_i | I)$ is the disability probability. Past research has confirmed relationships between this probability and measures of demographics ($\mathbf{X}_1$);[15,16,17] employment characteristics ($\mathbf{X}_2$),[16,18,19] including work environment;[17,20] injury characteristics ($\mathbf{X}_3$);[16,19] and the timeliness in provision of appropriate medical services ($\mathbf{X}_4$).[21]

A substantial literature has attempted to estimate equations (1) and (2) and identify factors associated with each. These studies face at least three types of data limitations that may reduce the estimations' applicability to policy and program decision making. First, available data generally do not allow estimation of both sets of probabilities. Many datasets, including workers' compensation claims or medical center visits describe only injured workers, enabling estimation of the disability probability but not injury incidence rate. This is problematic because a higher disability probability in a group may be interpreted differently if that group also had lower injury incidence (for example). Although some of these data could be combined with population counts to estimate incidence rates, the literature typically does not interpret incidence and disability jointly.

Second, available datasets generally preclude estimation of causal relationships—the *direct effect* of a risk factor on the disability probability—that is reflected in equation (2). Studies using observational data often identify risk factors—those characteristics in the $\mathbf{X}_i$ vectors that are associated with a greater incidence rate or disability probability—but cannot distinguish whether the greater risk is due to the direct effect of those factors or *proxy effects* that capture the effect of an unmeasured characteristic that is correlated with a risk factor. For example, the physical demands of a job might affect the injury rate or disability probability and be related to worker characteristics such as gender. As a result, gender may appear to affect incidence rates and disability probabilities, when it captures (that is, proxies for) for the job's physical demands. Estimating a more complete model can reduce proxy effects and provide an analysis of risk factors with more practical value. Research shows, for example, that females have higher incidence rates[22] and greater work absence once injured[16] than males, yet with more complete model specifications such differences disappear.[15] Such measurement of risk factors with more complete model specifications may help target efforts to prevent injuries or reduce their impact on the disability probability.

Finally, data used often apply to a specific injury, occupation, or industry, which identifies risk factors only in those groups. Fallacious comparisons across such studies might suggest inconsistencies in the factors associated with a disability probability. For example, the type of impairment was a key factor in returning to work in a study of partially disabled workers[19] but was less important than nonmedical factors (e.g., demographics) in a sample of patients in Level I trauma centers.[20]

This study builds on previous research by addressing or further illuminating the nature of these problems. We estimate both incidence rate (equation 1) and the disability probability (equation 2) for different groups of workers and jointly interpret both sets of probabilities. Our broad sample of workers covered under FECA and rich detail on worker and injury characteristics illustrates how estimates of the disability probability are sensitive to alternate specifications of equation (2) and how risk factors might differ across worker groups in ways that might limit generalizability of findings from analysis of a single injury, occupation, or industry. We show that considering incidence rate and proxy effects alters the interpretation of risk factors and that findings from a subpopulation has limited generalizability to the entire population.

III. Empirical Methods

A major advantage of our analysis is its investigation of rich claims data from FECA. The FECA program provides insurance against costs of a work-related injury to the approximately 2 million appropriated fund civilian federal employees.[23, 24] The program insures a relatively large proportion of the nation's workforce and covers a wide variety of work-related injuries and illnesses incurred in a broad set of occupations across the country, with claimants subject to the same compensation rules and therefore the same set of incentives to return to work following a work-related injury. FECA staff members record a wealth of information in a database when they administer the program. The public-use version of this database (http://www.dol.gov/asp/evaluation/AllStudies.htm) describes 800,791 workplace injury and illness claims reported from January 1, 2005, through December 31, 2010. The database does not include denied claims and includes both traumatic injuries, those occurring in a single day, and occupational illnesses, those occurring over more than one day. Each record describes the claimant at the time the injury was reported, pre-injury employment, and work outcomes during the first year after the injury was reported.

Three features about the data need to be emphasized. First, they do not contain claims in which work outcomes were not relevant to returning to work following an injury (e.g., a fatality) or the information did not meet data quality checks (e.g., dates of key events in the processing of a claim are inconsistent).[25] Second, they contain information on injuries reported and not on individual claimants, which makes claimants with more than one reported injury included separately for each claim filed. Studies of other workers' compensation programs show a prevalence of multiple claims,[26, 27] which suggests our standard error calculations might ignore some correlation among outcomes of individuals with multiple claims. Third, they contain only *reported* injuries. An estimated 40 percent of injured workers do not submit a workers' compensation claim, with about 30 percent of those workers losing time from work.[28] Our estimated relationship between risk factors and work outcomes might therefore be biased because those with less serious injuries are less likely to report them.

Injury incidence as a context for disability probability. We use employment data from FedScope (http://www.fedscope.opm.gov/|employment.asp) to compute the number of reported injuries per 1,000 covered federal workers (incidence rate) for all federal workers and the different groups included in FedScope, and use a chi-squared test to establish differences in rates across groups. Groups with higher incidence rates would have either a greater probability to sustain a work-related injury or to file a claim if injured. Although we do not have a single data source to measure injury incidence and disability risk, we jointly assess the two to provide a context—lacking in studies using only data on injured workers—for interpreting findings on the risk factors of disability and illustrate what policy-relevant information might be lost in assessing injury and disability risks separately.

Measuring disability. We use the loss of wage-earning capacity to capture an injury's impact on productivity. This measure defines disability as an absence, reduction in hours, or transfer to a lower-paying job that is due to the work-related injury, as supported by medical evidence. We developed two dichotomous measures of the disability probability from this measure. An injury leads to *any disability* if the claimant was not working full-time at the pre-injury wage at any time during the first year after the injury was reported. An injury leads to *long-term disability* if the claimant was not working, or was working at a lower-paying job, one year after the injury was reported. Both measures use the pre-injury wage as a baseline measure to capture productivity lost. Any drop in wage over the course of one year indicates a disability, and any work absence, reduction in hours, or lower pay one year after the injury indicates a long-term disability.

Measuring risk factors. Identifying risk factors requires measures of them. Although no data set contains exhaustive information on demographics ($\mathbf{X}_1$), employment characteristics ($\mathbf{X}_2$), and injury characteristics and severity ($\mathbf{X}_3$), the FECA data contain rich measures of key factors identified in equation (2). Demographic characteristics include gender, age, and dependent status; employment characteristics include occupation categories and employing department (analogous to industry); and injury characteristics include the nature, area, and cause of injury, and whether the injury was characterized as a traumatic injury or occupational illness (i.e., injury type). Although some studies attempt to quantify injury severity by measuring proxies, (i.e., quantities correlated with injury severity) we believe such measures are more appropriately considered disability outcomes (e.g., time missed from work) or injury-appropriate services (e.g., medical payments made). We do not include injury-appropriate services ($\mathbf{X}_{4i}$) administered *after* the injury occurs in our analytic model because their inclusion would not be useful for identifying risk factors at the time of the injury even if they could be empirically separated from injury severity. The online appendix provides details about all measures.

We initially compute the (unadjusted) disability probability for both disability measures and different worker groups, defined by **X** (i.e., demographics, employment characteristics, and injury characteristics). For each group, we use a two-tailed *t*-test to determine whether the mean of each disability measure differs significantly ($p < 0.05$) between that group and all other injury claims.

Identifying proxy effects. Although no observational data set on injuries can fully separate direct and proxy effects, adjusting for known risk factors can help reduce them. Intuitively, we wish to compare the disability probability of individuals with a high value of a given risk factor to that of individuals with a low value of that risk factor but otherwise similar characteristics. Accordingly, we adjust average disability rates for measurable risk factors by estimating an ordinary least squares (OLS) regression and compute the adjusted disability probability:

(3) $Y_i |_I = \alpha + \boldsymbol{\beta}_1 ' \mathbf{X}_{1i} + \boldsymbol{\beta}_2 ' \mathbf{X}_{2i} + \boldsymbol{\beta}_3 ' \mathbf{X}_{3i} + \varepsilon_i$

where Y_i is one of the two binary measures of disability probability, each **X** is a vector of risk factors--demographics ($\mathbf{X}_{1i}$), employment characteristics ($\mathbf{X}_{2i}$), and injury characteristics ($\mathbf{X}_{3i}$)--and ε_i is an idiosyncratic error term. The adjusted mean for a group, such as injuries among healthcare workers, is computed as the predicted value of the disability outcome for an individual in that group who has the mean value of all other characteristics. We performed a *t*-test to determine whether each adjusted mean (adjusted disability probability) differed significantly ($p < 0.05$) from the unadjusted mean (unadjusted disability probability) of all other individuals to examine how proxy effects might distort estimates of disability probability. The coefficient on an indicator variable for a given group represents the difference in adjusted disability rates between that group and the omitted category for that characteristic, adjusting for differences in other characteristics. Equivalently, the coefficients that differ from zero identify the risk factors associated with disability.

Risk factors across groups. We use the same regression framework to examine how risk factors associated with a disability probability might differ across groups. For this, we stratify equation (3) by demographic characteristics, employment characteristics, and injury type, excluding the corresponding vector of characteristics from stratified estimations. For example, when stratifying by age, $\mathbf{X}_1$ includes indicators for gender and dependents but not age. Coefficients from stratified estimations quantify risk factors for each group and differences in risk factors across groups suggest that programs and policies intended to address disabilities among high-risk groups should be based on information only for a specific population of interest. More broadly, such differences would dictate caution in extrapolating findings from much of the existing literature, which examines risk factors using data on very specific groups.

IV. Findings

We discuss findings in the three areas in which this research extends the current literature: joint examination of injury incidence and disability probability; proxy effects; and differences in risk factors across groups. Because the large number of observations in the FECA data produces statistically significance in even small differences in probabilities across groups, we focus our discussion on relatively large differences that could reasonably be considered the most substantive.

A. Injury incidence as a context for disability probability

Not all workers were equally likely to report a work-related injury through FECA (Table 1). In 2010, each 1,000 covered employees filed an average of 42 FECA claims. This incidence rate differed slightly across demographic groups and dramatically across employing department. For example, youth (workers aged 14 to 24) reported higher incidence rates than average (80 injuries per 1,000 workers) but other aged groups reported near average rates (42 injuries per 1,000 workers). A larger spread existed across employing department: employees in the Department of Homeland Security reported 67 injuries per 1,000 covered workers, while employees in the Department of Defense reported 28.

When incidence rates are interpreted alongside the disability probabilities across groups (Table 2), we can see how analysis of only disability probabilities might produce misleading conclusions. Overall, disability probabilities were 10.6 percent for any disability and 4.1 percent for long-term disability. Youth, however, had far lower disability probabilities (4.2 and 1.9 percent, unadjusted), despite having higher-than-average injury rates. Employees of the Department of Defense, who had lower-than-average injury rates (28 versus 42 injuries per 1,000 workers), also had lower-than-average disability probabilities (8.3 and 3.0 percent, unadjusted). Employees of the Department of Homeland Security, with extremely high incidence rates, had fairly typical disability probabilities (9.8 and 4.0 percent, unadjusted). Incidence rates alone might suggest expending a disproportionate amount of resources on youth and Homeland Security employees, even though these groups—especially youth—have injuries that are relatively unlikely to result in a disability.

Still, differences in disability probabilities in isolation from injury rates can inform which types of injuries have a relatively high likelihood of being severe. In fact, differences in (unadjusted) disability probabilities across injury characteristics recorded in the FECA data were generally much greater than differences across groups of workers (Table 2). The disability probability for any disability ranged from 4.2 (wound) to 13.4 (pain) in categories of nature of injury; from 3.9 (head, internal) to 21.2 (shoulder) in areas of injury; from 2.0 (animal or insect) to 15.6 (handling mail) in cause of injury and 9.6 for traumatic injury and 17.1 for occupational illness. Patterns across groups in long-term disability were qualitatively similar, but the differences were smaller in magnitude, consistent with the lower probability of this measure overall. The low R squared values (0.02 to 0.05) in these specifications are a reminder that although we have identified statistically significant and potentially useful relationships, many other factors affect whether work-related injuries are associated with a disability.

B. Identifying proxy effects

The differences in disability probability across groups may reflect both inherent differences across those groups (direct effects) and proxy effects. If adjustments for differences in characteristics across groups reduce risk factors or differences in risk factors across groups, it suggests that some correlates of disability proxy for other risk factors. For example, because adjustments in risk factors reduced the variance in disability probabilities across occupational groups, as compared to the unadjusted disability probabilities, occupation may be a proxy for other risk factors such as industry. More concretely, injured office and administrative support workers had higher disability probabilities than protective service workers (13 percent versus 9 percent for any disability), but injured workers in both occupations who have otherwise similar characteristics have nearly equal disability probabilities. Disregarding this proxy effect may, for example, suggest the need to target resources towards office and administrative support workers when no evidence exists of an inherent difference in risk across these occupations.

Not all differences across groups were reduced by adjusting for characteristics, possibly suggesting inherent differences in risk factors across groups. For example, the adjusted mean of any disability differed from the unadjusted mean by less than 2 percentage points for all employing departments. Furthermore, the disability probabilities following internal head injuries or leg injuries differed more when comparing otherwise similar injured workers, suggesting that unadjusted means may understated the inherent differences in disability probabilities between these injury locations. Patterns across groups were similar for long-term disability.

C. Differences in risk factors across groups

Risk factors for disability differed across groups in two ways. Patterns in risk factors were similar across groups, but showed greater risk in some groups than others (Tables 3 and 4) and some risk factors identified for all claimants were not associated with an increased disability probability for specific subgroups. Furthermore, risk factors were not necessarily additive: the presence of two or more risk factors may be greater or smaller than the sum of individual risks. For example, occupational illnesses among postal workers had higher disability probabilities than the two risk factors alone would suggest: Occupational illnesses were 6 percentage points more likely to result in any disability than otherwise similar traumatic injuries, while injuries or illnesses reported by Veterans Affairs workers were 8 percentage points less likely to result in any disability than otherwise similar injuries or illnesses reported by Postal Service workers. Yet the gap in disability probability across departments more than doubled to nearly 17 percentage points when comparing occupational illnesses. By contrast, older workers had a low disability probability from internal head injuries (10 percentage points lower than external trunk injuries) despite having a higher disability probability overall (1 percentage point higher than middle-aged workers.

Injury characteristics. Risk factors were similar across injury type but frequently had a greater disability probability following occupational illnesses than traumatic injuries (Table 3). Although the same characteristics tended to predict a greater disability probability for both traumatic injuries and occupational illnesses, each disability probability was nearly twice as common following occupational illnesses, with the increase found in the aggregate and among many subgroups. For example, occupational illnesses sustained by workers with dependents and employees of the U.S. Postal Service had higher disability probabilities for any disability than otherwise similar traumatic injuries. Some risk factors predicted substantially greater risk for occupational illnesses, such as injuries and illnesses occurring in the hand, perhaps due to the differences in the types of work-related conditions that arise over multiple days (occupational illnesses) versus a single event or day (traumatic injuries).

Demographics. Patterns in risk factors were similar across demographic groups, but sometimes levels of the disability probabilities differed across groups (Table 4). For example, knee and shoulder injuries were risk factors of any disability for both genders but males had a greater numeric disability probability. By contrast, occupational illness was associated with a greater disability probability for female workers. Injuries affecting the knee, arm, or shoulder had higher disability probabilities if sustained by a worker age 25 or older, while injuries affecting the head internally were had lower disability probabilities for older workers. Patterns were similar for risk factors of long-term disability, but quantitative differences in risk factors were small for workers with and without dependents.

Employment Characteristics. Differences in risk factors across employing department varied, particularly among demographic risk factors (detailed results available from the authors). For example, gender did not appear to affect the disability probability among injuries reported by Department of Defense employees, but was 3 percentage points higher if reported by a female in the U.S. Postal Service. Associations between injury characteristics and risk factors also varied with department. For example, disability probabilities for shoulder injuries were higher when reported by U.S. Postal Service or Department of Defense workers. Few differences existed in risk factors across occupation and the few differences that appeared were very small.

V. Summary and Discussion

The research used the FECA data to extend the literature on risk factors associated with incurring a disability after a work-related injury. These data cover a broad population of workers' compensation claims and allow us to assess the demographic, employment characteristics, and injury characteristic risk factors associated with a greater disability probability. When augmented with information from FedScope, we can jointly assess workplace injury rates and disability probabilities.

Research findings extended the discussion of risk factors associated with work-related incidence rates and disability probabilities by providing a clearer context for much of the literature. We showed that examinations of risk factors for disability may be limited if interpreted without the context of incidence rates, estimated with incomplete model specification, or estimated on a narrowly defined population. We provided evidence of the impacts of these three limitations on studies of risk factors.

First, jointly examining injury incidence rates and disability probabilities challenges some conclusions by research by examining the two separately. Policy makers might overstate the need for programs or services to reduce risk of disability among youth, for example, based only on information about their high injury incidence rates. Alternatively, they might understate this need based on their low disability probability. Only with knowledge of both injury incidence rates and disability probabilities can resources can be appropriately targeted for this group.

Second, the research suggests that the higher risk among some groups might be explained by the presence of other risk factors in those groups. In isolation, some characteristics such as the office and administrative support occupation appear to be risk factors for disability following injury, but a more comprehensive analysis suggests these injuries are at no greater risk than similar injuries from other occupational groups. Apparently employment in office and administrative support jobs captures other characteristics common among those injuries that were associated with higher disability probabilities. Targeting resources to groups with high disability probabilities might be unwarranted given that the probability may reflect another characteristic rather than an inherent risk of those groups.

Finally, the qualitative consistency of the associations between characteristics and disability probabilities across groups shown in this research allows for broad generalizations about risk factors but their quantitative differences across groups dictate caution in applying the level of risk across groups. That is, a risk factor identified in one occupation (for example) is likely to be a risk factor in other occupations, but the factor may be associated with a greater disability probability in some occupations than others. Information about these numerical differences may be useful in developing policies and procedures for helping specific groups of injured workers.

Further research on disability following work-related injury is warranted. This paper shows the importance of evaluating risk factors for disability within the context of incidence rates, but we measure disability and incidence using separate data sources. Individual-level data on both workplace injuries and all workers would be required to model incidence and disability jointly. Furthermore, like any analysis of observational data, we cannot ascertain whether the risk factors identified cause disability or merely proxy for an unobserved factor. Accordingly, this research is appropriate for identifying groups of injured workers at higher risk of disability but not for evaluating the effectiveness of a particular intervention for those workers.

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Table 1. Workplace Injury Incidence Rates Among Federal Employees in 2010

	Number of Employees	Number of Injuries	Incidence Rate
United States	1,926,279	79,952	41.5
Demographic Characteristics			
Gender			
Female	826,513	33,795	40.9
Male	1,099,765	46,157	42.0
Age			
14–24	69,897	5,583	79.9
25–54	1,332,938	54,037	40.5
55 +	473,995	19,033	40.2
Employment Characteristics			
Department			
Defense	764,299	21,640	28.3
Homeland Security	188,983	12,617	66.8
Veterans Affairs	308,814	14,160	45.9
Other departments	664,183	31,535	47.5

Source: FECA Administrative Data, available at http://www.dol.gov/asp/evaluation/AllStudies.htm, and FedScope data, available at http://www.fedscope.opm.gov/employment.asp.

Notes: Number of employees as measured in September 2010, and incidence rate is the ratio of injuries per 1,000 employees. FedScope defines groups differently than the FECA data, so the number of covered employees in a group may be overestimated or underestimated. Comparisons by occupation were untenable, and the U.S. Postal Service is excluded from this table. 1,299 FECA claims with missing age are excluded from the age tabulation.

Table 2. Characteristics of Claims with Disability

	Distribution		Any Disability		Long-Term Disability	
	Number	Percentage	Mean	Adjusted Mean	Mean	Adjusted Mean
All	800,791	100.0	10.6	10.6	4.1	4.1
Demographic Characteristics						
Gender						
Male	452,770	56.5	9.5*	9.9*	3.6*	3.7*
Female	347,936	43.4	11.9*	11.5*	4.9*	4.7*
Age						
14–24	39,009	4.9	4.2*	7.5*	1.9*	3.1*
25–54	576,288	72.0	10.6*	10.5	4.1	4.1*
55+	177,702	22.2	11.7*	11.3*	4.5*	4.5*
Has Dependents						
No	349,321	43.6	10.0*	9.9*	4.2	3.9*
Yes	451,470	56.4	11.0*	11.1*	4.1	4.3*
Employment Characteristics						
Occupation						
Office and administrative support	243,554	30.4	13.5*	10.6*	5.3*	4.2*
Protective service	60,244	7.5	8.5*	10.5*	3.0*	3.6*
Healthcare	52,272	6.5	10.1*	12.1*	5.1*	5.7*
Installation, maintenance, and repair	41,443	5.2	8.9*	11.7*	3.1*	4.3*
Business and financial	33,097	4.1	10.1*	10.5	3.7*	3.5*
Other occupations	140,968	17.6	8.6*	11.1*	3.3*	4.2
Department						
U.S. Postal Service	327,051	40.8	13.9*	13.7*	5.3*	5.2*
Defense	133,347	16.7	8.3*	8.8*	3.0*	3.3*
Homeland Security	93,146	11.6	9.8*	9.4*	4.0	4.0*
Veterans Affairs	78,781	9.8	8.0*	6.2*	3.3*	2.1*
Other departments	168,466	21.0	7.5*	8.5*	3.2*	3.7*
Injury Characteristics						
Nature of Injury						
Sprain	162,819	20.3	12.2*	10.5*	4.0*	3.9*
Wound	149,826	18.7	4.2*	6.2*	1.8*	2.6*
Back	101,440	12.7	10.6	11.5*	5.4*	5.2*
Pain	61,125	7.6	13.4*	10.9*	5.0*	4.2
Other natures	325,581	40.7	12.1*	12.2*	4.7*	4.6*
Area of Injury						
External (trunk area)	143,022	17.9	10.5	9.6*	5.2*	4.4*
Knee	81,298	10.2	16.3*	16.7*	5.0*	5.3*
Arm	69,726	8.7	11.9*	11.5*	4.1	4.0
Shoulder	59,127	7.4	21.2*	19.6*	7.1*	6.7*
Head, external	57,835	7.2	6.6*	7.9*	3.3*	3.8*
Leg	56,738	7.1	9.0*	10.4*	3.4*	4.1*
Head, internal	49,446	6.2	3.9*	2.4*	2.2*	1.8*
Hand	43,539	5.4	10.3	10.3	3.7*	3.7*
Other areas	240,060	30.0	8.4*	9.0*	3.3*	3.6*
Cause of Injury						
Fall	140,188	17.5	12.1*	12.7*	4.5*	4.8*
Handling mail	81,016	10.1	15.6*	12.2*	6.3*	4.7*
Handling equipment	76,511	9.6	12.3*	11.0*	4.5*	4.1
Slip	58,568	7.3	12.3*	11.4*	4.1	4.1
Animal or insect	46,448	5.8	2.0*	3.8*	1.0*	1.7*
Other causes	398,060	49.7	9.4*	10.1*	3.9*	4.1*
Injury Type						
Traumatic Injury	693,491	86.6	9.6*	9.7*	3.8*	3.8*
Occupational Illness	107,300	13.4	17.1*	15.8*	6.5*	6.1*
Number of Claims	800,791		n.a.		n.a.	

Source: FECA Administrative Data, available at http://www.dol.gov/asp/evaluation/AllStudies.htm.

Note: The number and percentage of claims (out of 800,791) in each category is shown in the first and second columns. Categories for missing gender (85), age (7,792), or occupation (229,213) are not shown. The remaining columns show the means and adjusted means (in percentages) of the disability probability within each group. Adjusted means are regression adjusted to the mean of all other independent variables and location dummies. n.a. means not applicable.

* indicates that the mean or adjusted mean for that group differs statistically from that of all other claims ($p \leq 0.05$).

Table 3. Characteristics and Disability in Aggregate and by Injury Type: Multivariate Analysis

	Any Disability			Long-Term Disability		
	All Claims	Traumatic Injury	Occupational Illness	All Claims	Traumatic Injury	Occupational Illness
Demographic Characteristics						
Female	0.016*	0.011*	0.040*	0.011*	0.009*	0.019*
Age (25–54)						
14–24	-0.030*	-0.030*	-0.058*	-0.010*	-0.010*	-0.024*
55+	0.008*	0.012*	-0.002	0.004*	0.005*	0.002
Has Dependents	0.012*	0.010*	0.023*	0.004*	0.004*	0.007*
Employment Characteristics						
Occupation (Office and administrative support)						
Protective service	-0.001	-0.003	-0.021*	-0.006*	-0.007*	-0.005
Healthcare	0.015*	0.018*	-0.013*	0.015*	0.016*	0.003
Installation, maintenance, and repair	0.011*	0.012*	0.004	0.001	0.002	-0.002
Business and financial	-0.001	0.000	0.007	-0.007*	-0.008*	0.003
Other occupations	0.004*	0.004*	-0.002	0.000	-0.000	0.001
Department (U.S. Postal Service)						
Defense	-0.050*	-0.040*	-0.090*	-0.019*	-0.014*	-0.040*
Homeland Security	-0.043*	-0.032*	-0.111*	-0.013*	-0.007*	-0.048*
Veterans Affairs	-0.076*	-0.058*	-0.165*	-0.031*	-0.024*	-0.068*
Other departments	-0.052*	-0.044*	-0.104*	-0.016*	-0.011*	-0.040*
Injury Characteristics						
Nature of Injury (Sprain)						
Wound	-0.043*	-0.044*	-0.166*	-0.013*	-0.013*	-0.032
Back	0.010*	0.005*	-0.075*	0.014*	0.011*	0.004
Pain	0.004*	0.000	-0.089*	0.003*	0.002	-0.016
Other natures	0.017*	0.013*	-0.075*	0.007*	0.006*	-0.011
Area of Injury (External, trunk area)						
Knee	0.071*	0.067*	0.054*	0.009*	0.006*	0.016*
Arm	0.019*	0.008*	0.060*	-0.004*	-0.005*	0.002
Shoulder	0.100*	0.094*	0.107*	0.023*	0.020*	0.026*
Head, external	-0.017*	-0.021*	-0.003	-0.006*	-0.007*	0.004
Leg	0.008*	0.003	0.031*	-0.003*	-0.005*	0.015*
Head, internal	-0.072*	-0.050*	-0.072*	-0.026*	-0.016*	-0.033*
Hand	0.007*	-0.026*	0.102*	-0.008*	-0.015*	0.014*
Other areas	-0.006*	-0.010*	0.010*	-0.008*	-0.009*	-0.004
Cause of Injury (Fall)						
Handling mail	-0.004*	-0.010*	0.072*	-0.001	-0.001	0.009
Handling equipment	-0.016*	-0.023*	0.073*	-0.008*	-0.009*	0.013
Slip	-0.013*	-0.013*	0.049*	-0.007*	-0.006*	-0.001
Animal or insect	-0.088*	-0.081*	-0.013	-0.031*	-0.029*	-0.008
Other causes	-0.026*	-0.026*	0.050*	-0.008*	-0.008*	0.014
Occupational Illness	0.061*	-	-	0.023*	-	-
Mean Dependent Variable	0.106	0.096	0.171	0.041	0.038	0.065
R^2	0.048	0.039	0.079	0.018	0.015	0.027
Number of Claims	800,791	693,491	107,300	800,791	693,491	107,300

Source: FECA Administrative Data, available at http://www.dol.gov/asp/evaluation/AllStudies.htm. Accessed June 13, 2014.

Note: Numbers are coefficients from ordinary least squares estimations of equation (1) except where noted. * indicates a significant ($p \leq 0.05$) coefficient. Omitted categories are in parenthesis after each category name. Variables for location in which the claim was filed were also included in the estimations as controls, but coefficients are not reported here. Full results are available from the authors.

Table 4

Table 4. Characteristics and Disability by Demographic Characteristics: Multivariate Analysis

	Any Disability							Long-Term Disability						
	Male	Female	14-24	25-54	55+	No dependents	Dependents	Male	Female	14-24	25-54	55+	No dependents	Dependents
Demographic Characteristics														
Female	--	--	-0.003	0.018*	0.014*	0.014*	0.019*	--	--	-0.000	0.012*	0.009*	0.010*	0.011*
Age														
14–24	-0.027*	-0.039*	--	--	--	-0.026*	-0.043*	-0.008*	-0.015*	--	--	--	-0.008*	-0.013*
55+	0.010*	0.008*	--	--	--	0.007*	0.008*	0.005*	0.004*	--	--	--	0.004*	0.004*
Has Dependents	0.010*	0.014*	-0.001	0.013*	0.014*	--	--	0.003*	0.005*	0.001	0.005*	0.004*	--	--
Employment Characteristics														
Occupation														
Protective service	-0.006*	0.006	-0.009	0.002	-0.005	-0.010*	0.006*	-0.009*	-0.002	-0.011*	-0.005*	-0.003	-0.010*	-0.004*
Healthcare	0.021*	0.016*	0.016*	0.017*	0.011*	0.009*	0.020*	0.023*	0.014*	0.028*	0.016*	0.009*	0.010*	0.018*
Installation, maintenance, and repair	0.006*	0.021*	-0.008	0.014*	0.012*	0.010*	0.015*	-0.003*	0.009*	-0.003	0.004*	-0.003	0.001	0.002
Business and financial	-0.001	0.003	-0.031*	0.001	0.000	-0.011*	0.008*	-0.009*	-0.003	-0.016*	-0.006*	-0.006*	-0.012*	-0.003
Other occupations	0.004*	-0.000	-0.020*	0.007*	0.006*	-0.004*	0.011*	-0.002	-0.000	-0.008*	0.001	0.002	-0.004*	0.003*
Department														
Defense	-0.035*	-0.070*	-0.028*	-0.050*	-0.049*	-0.050*	-0.050*	-0.011*	-0.030*	-0.011*	-0.019*	-0.020*	-0.019*	-0.019*
Homeland Security	-0.033*	-0.054*	0.006	-0.047*	-0.028*	-0.037*	-0.047*	-0.008*	-0.019*	-0.001	-0.014*	-0.005	-0.012*	-0.014*
Veterans Affairs	-0.057*	-0.090*	-0.028*	-0.078*	-0.075*	-0.074*	-0.077*	-0.019*	-0.040*	-0.015*	-0.032*	-0.032*	-0.031*	-0.032*
Other departments	-0.039*	-0.068*	-0.007	-0.055*	-0.052*	-0.054*	-0.051*	-0.008*	-0.025*	-0.001	-0.017*	-0.015*	-0.017*	-0.015*
Injury Characteristics														
Nature of injury														
Wound	-0.044*	-0.038*	-0.011*	-0.043*	-0.054*	-0.041*	-0.045*	-0.012*	-0.014*	-0.004	-0.013*	-0.015*	-0.013*	-0.013*
Back	0.003	0.020*	0.028*	0.013*	-0.005	0.013*	0.009*	0.013*	0.014*	0.014*	0.014*	0.012*	0.015*	0.013*
Pain	0.005*	0.006*	0.001	0.004*	-0.003	0.009*	-0.001	0.004*	0.002	0.002	0.002	0.004	0.007*	-0.001
Other natures	0.015*	0.021*	0.009*	0.014*	0.023*	0.016*	0.018*	0.007*	0.008*	0.003	0.006*	0.009*	0.007*	0.007*
Area of injury														
Knee	0.082*	0.054*	0.047*	0.074*	0.066*	0.059*	0.080*	0.010*	0.007*	0.012*	0.008*	0.011*	0.009*	0.008*
Arm	0.007*	0.029*	-0.000	0.016*	0.030*	0.015*	0.022*	-0.006*	-0.002	-0.003	-0.006*	-0.000	-0.005*	-0.003
Shoulder	0.106*	0.090*	0.031*	0.091*	0.130*	0.087*	0.109*	0.021*	0.024*	0.010*	0.019*	0.033*	0.024*	0.022*
Head, external	-0.025*	-0.008*	-0.007	-0.016*	-0.024*	-0.018*	-0.016*	-0.008*	-0.005*	-0.005	-0.006*	-0.008*	-0.007*	-0.006*
Leg	0.001	0.018*	0.010	0.004	0.022*	0.008*	0.008*	-0.004*	-0.002	0.002	-0.005*	-0.001	-0.004*	-0.003
Head, internal	-0.072*	-0.069*	-0.007	-0.065*	-0.096*	-0.062*	-0.079*	-0.025*	-0.028*	-0.001	-0.022*	-0.037*	-0.024*	-0.028*
Hand	-0.006*	0.017*	-0.001	0.005*	0.013*	0.005	0.009*	-0.010*	-0.007*	-0.001	-0.009*	-0.005	-0.008*	-0.008*
Other areas	-0.010*	-0.002	0.003	-0.007*	-0.007*	-0.010*	-0.003	-0.008*	-0.008*	-0.002	-0.009*	-0.008*	-0.009*	-0.007*
Cause of injury														
Handling mail	-0.011*	-0.003	-0.019*	-0.001	-0.012*	-0.006*	-0.003	-0.006*	-0.000	-0.007	-0.000	-0.004*	0.000	-0.002
Handling equipment	-0.020*	-0.019*	-0.020*	-0.014*	-0.020*	-0.021*	-0.013*	-0.010*	-0.008*	-0.008*	-0.008*	-0.007*	-0.008*	-0.007*
Slip	-0.019*	-0.010*	-0.024*	-0.010*	-0.011*	-0.015*	-0.011*	-0.008*	-0.007*	-0.011*	-0.006*	-0.008*	-0.008*	-0.006*
Animal or insect	-0.084*	-0.099*	-0.056*	-0.085*	-0.100*	-0.090*	-0.086*	-0.029*	-0.036*	-0.023*	-0.030*	-0.035*	-0.033*	-0.030*
Other causes	-0.030*	-0.028*	-0.023*	-0.024*	-0.030*	-0.027*	-0.025*	-0.010*	-0.008*	-0.008*	-0.007*	-0.008*	-0.008*	-0.007*
Occupational Illness	0.042*	0.078*	0.001	0.072*	0.043*	0.050*	0.068*	0.017*	0.028*	-0.002	0.027*	0.019*	0.020*	0.025*
Mean Dependent Variable	0.095	0.119	0.042	0.106	0.117	0.100	0.110	0.036	0.049	0.019	0.041	0.045	0.042	0.041
R^2	0.048	0.050	0.025	0.047	0.054	0.049	0.049	0.014	0.020	0.014	0.018	0.018	0.022	0.014
Number of Claims	452,855	347,936	39,009	576,288	177,702	349,321	451,470	452,855	347,936	39,009	576,288	177,702	349,321	451,470

Source: FECA Administrative Data, available at http://www.dol.gov/asp/evaluation/AllStudies.htm.

Note: Numbers are coefficients from ordinary least squares estimations of equation (3) except where noted. * indicates a significant ($p \le 0.05$) coefficient. See Table 4 for omitted categories. Location variables were also included in the estimations as controls, but coefficients are not reported here. Full results are available from the authors.

Clinical significance of
Understanding the Probability of a Disability Resulting from Work-Related Injuries

The article highlights caveats that practioners must consider when interpreting estimates of the risk that a workplace injury will lead to a disability. Estimated relationships between risk factors and disability probabilities vary with different groups of workers, the variables used in the computation, and the risk of injury initially.

ONLINE Appendix

Variable	Variable Construction	Number Missing
Outcomes		
Any disability	An indicator variable equal to 1 if the claimant had any days not working and 0 if no days of not working one year after the injury was reported; claimants are considered not working if they receive disability compensation or are in the Disability Management System and not working in a full-time job	0
Long-term disability	An indicator variable equal to 1 if the claimant is receiving disability compensation or is in the Disability Management System and not at a full-time job one year after the injury was reported and 0 otherwise	0
Demographic Characteristics		
Female	An indicator variable equal to 1 if the claimant is female and 0 otherwise	85
Age	The number of days from the report date and the claimant's birth date, divided by 365.25, and rounded to the nearest number; claims with values outside the 99th percentile of the age distribution (that is, an age younger than 14 or older than 68) are coded as missing	7,792
Has dependents	An indicator variable equal to 1 if the claimant has dependents and 0 otherwise	0
Employment Characteristics		
Occupation. Occupations are coded using a cross-walk from the Occupational Safety and Health Administration-coded occupations in the database to the 2000 Standard Occupation Classification system. The six occupations included represent at least 5 percent of reported injuries with nonmissing values.		
Business and financial	An indicator variable equal to 1 if the two-digit occupation code is business and financial operations occupations and 0 otherwise	229,213
Healthcare	An indicator variable equal to 1 if the two-digit occupation code is health care practitioners and technical occupations and 0 otherwise	229,213
Installation, maintenance, and repair	An indicator variable equal to 1 if the two-digit occupation code is installation, maintenance, and repair occupations and 0 otherwise	229,213
Office and administrative support	An indicator variable equal to 1 if the two-digit occupation code is office and administrative support occupations and 0 otherwise	229,213
Postal service workers	An indicator variable equal to 1 if the five-digit occupation code is postal service workers and 0 otherwise	229,213
Protective service	An indicator variable equal to 1 if the two-digit occupation code is protective service worker and 0 otherwise	229,213
Other occupations	An indicator variable equal to 1 if the two-digit occupation code is not listed above and 0 otherwise	229,213
Employing Department. Options include the U.S. Departments of Agriculture, Commerce, Defense, Education, Energy, Health and Human Services, Homeland Security, Housing and Urban Development, Justice, Labor, State, Interior, Transportation, Treasury, Veterans Affairs, Environmental Protection Agency, Executive Office of the President, Government Printing Office, National Aeronautics and Space Administration, Peace Corps, Social Security Administration, Tennessee Valley Authority, or the U.S. Postal Service. The four departments identified represent at least 5 percent of all reported injuries.		
Defense	An indicator variable equal to 1 if the employing department is the Department of Defense and 0 otherwise	0
Homeland Security	An indicator variable equal to 1 if the employing department is the Department of Homeland Security and 0 otherwise	0
Veterans affairs	An indicator variable equal to 1 if the employing department is the Department of Veterans Affairs and 0 otherwise	0
U.S. postal service	An indicator variable equal to 1 if the employing department is the U.S. Postal Service and 0 otherwise	0
Other departments	An indicator variable equal to 1 if the employing department is listed above and 0 otherwise	0

Variable	Variable Construction	Number Missing
Injury Characteristics		
Nature of Injury	The four natures identified represent at least 5 percent of reported injuries with nonmissing values.	
Back	An indicator variable equal to 1 if the nature of the injury is back sprain/strain, back pain, subluxation or back sprain/strain, back pain, or subluxation or invertebratal disc disorder and 0 otherwise	123,758
Pain	An indicator variable equal to 1 if the nature of the injury is pain/swelling/stiffness/redness in joint or pain/swelling/stiffness/redness not in joint and 0 otherwise	123,758
Sprain	An indicator variable equal to 1 if the nature of the injury is sprain/strain of ligament, muscle, tendon, or not back and 0 otherwise	123,758
Wound	An indicator variable equal to 1 if the nature of the injury is contusion, laceration, superficial wounds, or puncture wound and 0 otherwise	123,758
Other natures	An indicator variable equal to 1 if the nature of the injury is not listed above and 0 otherwise	123,758
Area of Injury	The eight areas identified represent at least 5 percent of all injuries with nonmissing areas of injury	
Arm	An indicator variable equal to 1 if the area of the injury is the arm and 0 otherwise	2,008
External (trunk area)	An indicator variable equal to 1 if the area of the injury is external and in the trunk area and 0 otherwise	2,008
Hand	An indicator variable equal to 1 if the area of the injury is the hand and 0 otherwise	2,008
Head, external	An indicator variable equal to 1 if the area of the injury is external to the head and 0 otherwise	2,008
Head, internal	An indicator variable equal to 1 if the area of the injury is internal to the head and 0 otherwise	2,008
Knee	An indicator variable equal to 1 if the area of the injury is the knee and 0 otherwise	2,008
Leg	An indicator variable equal to 1 if the area of the injury is the leg and 0 otherwise	2,008
Shoulder	An indicator variable equal to 1 if the area of the injury is the shoulder and 0 otherwise	2,008
Other areas	An indicator variable equal to 1 if the area of the injury is not listed above and 0 otherwise	2,008
Cause of Injury	The causes identified represent at least 5 percent of all injuries with nonmissing causes of injury	
Animal or insect	An indicator variable equal to 1 if the cause of the injury is animals/insects or dog bite and 0 otherwise	238,787
Fall	An indicator variable equal to 1 if the cause of the injury is fall on floor/work surface/aisle, fall on stairway or steps, fall on walkways/curbs/porches, fall from scaffold or platform, fall from ladder, fall from chair/stool/rest bar, fall from desk/table/workbench, fall into hole/hatch/chute, fall on deck, fall on road/highway/street, fall from stacked cargo, fall on hill or slope, fall from ramp/runway/gangplank, fall off dock; fall from machinery, fall from stopped vehicle, fall getting on/off elevator, fall inside moving vehicle, or fall and 0 otherwise	238,787
Handling mail	An indicator variable equal to 1 if the cause of the injury is handling packaged material, weight stated; handling packaged material, weight not stated; handling mail containers; or handling magazines or papers and 0 otherwise	238,787
Handling equipment	An indicator variable equal to 1 if the cause of the injury is handling manual equipment and 0 otherwise	238,787
Slip	An indicator variable equal to 1 if the cause of the injury is slip—not falling or slip/twist/trip—not falling and 0 otherwise	238,787
Other causes	An indicator variable equal to 1 if the cause of the injury is not listed above and 0 otherwise	238,787
Injury Type		
Traumatic injury	An indicator variable equal to 1 if the claimant has a traumatic injury and 0 otherwise	0
Occupational illness	An indicator variable equal to 1 if the claimant has an occupational illness and 0 otherwise	0

Variable	Variable Construction	Number Missing
Suppressed in Tables		
Location	Twelve indicator variables with each equal to 1 to designator an office processing the claim and 0 otherwise. Indicator variables include Boston (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont), Chicago (Illinois, Minnesota, Wisconsin), Cleveland (Indiana, Michigan, Ohio), Dallas (Louisiana, Oklahoma, and Texas), Denver (Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming), Jacksonville (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee), Kansas City (Arkansas, Iowa, Kansas, Missouri, and Nebraska; all employees of the Department of Labor, except Job Corps enrollees, and their relatives), New York (New Jersey, New York, Puerto Rico, and the Virgin Islands), Philadelphia (Delaware, Pennsylvania, and West Virginia; Maryland if the zip code of the claimant's residence begins 21), San Francisco (Arizona, California, Hawaii, and Nevada), Seattle (Alaska, Idaho, Oregon, and Washington), and Washington, DC (District of Columbia, Virginia; Maryland when the zip code of the claimant's residence is other than 21)	0